

## **CLAIMS**

What is claimed is:

- 5     1.     A gypsum board, comprising:
  - a.   a gypsum matrix having a bottom and a top;
  - b.   a first facer sheet placed on the bottom of said gypsum matrix;
  - c.   a second facer sheet placed on the top of said gypsum matrix;
  - d.   one or more glass fibers placed within said gypsum matrix; and
  - 10   e.   a silane based sizing composition coating said glass fibers,  
said coating providing increased strength, flexure resistance and nail pull  
out resistance to said gypsum board.
- 15     2.     A gypsum board as recited by claim 1, wherein each of said first and said  
second facer sheets comprises Kraft paper.
- 20     3.     A gypsum board as recited by claim 1, wherein said gypsum matrix comprises  
calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ ), calcium sulphate  
anhydrite ( $\text{CaSO}_4$ ), hydraulic setting cement and water.
- 25     4.     A gypsum board as recited by claim 1, wherein said hydraulic setting cement  
is selected from the group consisting of Portland cements, sulphate  
resisting cements, blast furnace cements, pozzolanic cements, and high  
alumina cements.
- 30     5.     A gypsum board as recited by claim 1 wherein said silane based sizing  
composition coating comprises polymethylsiloxane.
6.     A gypsum board as recited by claim 1, wherein said silane based sizing  
composition includes a hydrophobic moiety whereby said hydrophobic moiety  
functions to cause said silane based sizing composition to adhere to said glass  
fibers.

7. A gypsum board as recited by claim 1, wherein said silane based sizing composition includes a hydrophilic moiety whereby said hydrophilic moiety interacts with water present in said gypsum mix.
- 5 8. A gypsum board as recited by claim 1, wherein said hydrophobic moiety is selected from a group consisting of an amino group, a methacryl group and an alkyl functional group.
- 10 9. A gypsum board as recited by claim 1, wherein said hydrophilic moiety comprises poly(ethylene) oxide or poly(ethylene) imine.
- 15 10. A gypsum board as recited by claim 1, wherein said silane based sizing composition comprises a plurality of silane molecules having single or cross linked polydimethylsiloxane chains.
- 20 11. A gypsum board as recited by claim 1, wherein said silane based sizing composition comprises a plurality of silane molecules having multi branched chains.
- 25 12. A gypsum board as recited by claim 7, wherein said plurality of silane molecules having multi branched chains are crosslinked with a T type cross link that hardens into a pseudo polymer network during gypsum cure.
- 30 13. A gypsum board as recited by claim 7, wherein said plurality of silane molecules having multi branched chains are crosslinked with a Q type cross link that hardens into the pseudo polymer network during gypsum cure.
14. A gypsum board as recited by claim 1, wherein said silane based sizing composition is multi branched with a hydrophobic termination attached to said glass fiber and said multi branched sizing diffuses into said wet gypsum mix hardening during gypsum cure cycle into a pseudo polymeric network in the microstructurally identifiable bond region adjacent to said glass fiber reinforcement within said gypsum matrix.

15. A gypsum board as recited by claim 1, wherein said silane based sizing composition has a thickness ranging from about 0.25 to 6 microns.
16. A gypsum board, comprising:
- 5           a. a gypsum matrix having a top and a bottom;
- b. a first facer sheet placed on the bottom of said gypsum matrix;
- c. a second facer sheet placed on the top of said gypsum matrix; and
- d. at least one mat composed of glass fibers coated with a silane based
- 10           sizing composition, and being disposed within said gypsum matrix
- before said board is subjected to a curing process,
- said mat being operative to increase strength, flexure resistance and nail
- pull out resistance of said gypsum board.
17. A gypsum board as recited by claim 16, wherein each of said first and said
- 15           second facer sheets comprises Kraft paper.
18. A gypsum board as recited by claim 16, wherein said gypsum matrix comprises
- a gypsum mix including calcium sulphate hemihydrate ( $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ ),
- calcium sulphate anhydrite ( $\text{CaSO}_4$ ), hydraulic setting cement and
- 20           water.
19. A gypsum board as recited by claim 16, wherein said hydraulic setting
- cement is selected from the group consisting of Portland cements,
- sulphate resisting cements, blast furnace cements, pozzolanic cements, and
- 25           high alumina cements.
20. A gypsum board as recited by claim 16 wherein said silane based sizing
- composition coating comprises polymethylsiloxane.
- 30   21. A gypsum board as recited by claim 16, wherein said silane based sizing
- composition includes a hydrophobic moiety whereby said hydrophobic moiety
- functions to cause said silane based sizing composition to adhere to said glass
- fibers.

22. A gypsum board as recited by claim 16, wherein said silane based sizing composition includes a hydrophilic moiety whereby said hydrophilic moiety interacts with water present in said gypsum mix.
- 5 23. A gypsum board as recited by claim 16, wherein said hydrophobic moiety is selected from a group consisting of an amino group, a methacryl group and an alkyl functional group.
- 10 24. A gypsum board as recited by claim 16, wherein said hydrophilic moiety comprises poly(ethylene) oxide.
- 15 25. A gypsum board as recited by claim 16, wherein said silane based sizing composition comprises a plurality of silane molecules having single or cross linked polydimethylsiloxane chains.
- 20 26. A gypsum board as recited by claim 16, wherein said silane based sizing composition comprises a plurality of silane molecules having multi branched chains.
- 20 27. A gypsum board as recited by claim 26, wherein said plurality of silane molecules having multi branched chains are crosslinked with a T type cross link that hardens the pseudo polymer network during gypsum cure.
- 25 28. A gypsum board as recited by claim 26, wherein said plurality of silane molecules having multi branched chains are crosslinked with a Q type cross link that hardens the pseudo polymer network during gypsum cure.
- 30 29. A gypsum board as recited by claim 16, wherein said silane based sizing composition is multi branched with a hydrophobic termination that attaches to said glass fiber and said multi branched sizing diffuses into said wet gypsum mix hardening during gypsum cure cycle into a pseudo polymeric network in the microstructurally identifiable bond region adjacent to said glass fiber reinforcement within said gypsum matrix.

30. A gypsum board as recited by claim 16, wherein said silane based sizing composition is from 0.25 to 6 microns thick.
31. A process for manufacturing a gypsum board, comprising the steps of:
- 5           a. coating a silane based sizing composition onto a plurality of glass fibers;
- b. forming an aqueous slurry comprising at least one member selected from the group consisting of anhydrous calcium sulphate, calcium sulphate hemi-hydrate, hydraulic setting cement and water;
- 10          c. mixing said plurality of glass fibers having a coating of silane based sizing composition with said aqueous slurry;
- d. distributing said aqueous slurry to form a layer on said first facer;
- e. applying said second facer onto the top of said slurry layer;
- f. separating the resultant laminate into individual gypsum boards; and
- 15          g. drying said gypsum boards during a gypsum cure cycle.
32. A process for manufacturing a gypsum board, comprising the steps of:
- a. forming an aqueous slurry comprising at least one member selected from the group consisting of anhydrous calcium sulphate, calcium sulphate hemi-hydrate, hydraulic setting cement and water;
- 20          b. distributing said aqueous slurry to form a layer on said first facer;
- c. incorporating organized structures including mats of silane based sizing composition coated reinforcing glass fibers into said aqueous slurry layer;
- 25          d. applying said second facer onto the top of said slurry layer;
- e. separating the resultant laminate into individual gypsum boards; and
- f. drying said gypsum boards during a gypsum cure cycle.